

WALL-HUGGER FUTON

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/447,285, filed February 14, 2003.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0002] The present invention relates to sofa beds, and in particular to sofa beds which include linkage support assemblies that control the relative movement of back and seat frames therein when the seat frame is manually gripped and moved to shift the back frame and the seat frame from a couch positioning to a bed positioning and visa versa.

THE PRIOR ART

[0003] Sofa beds are items of furniture which can be shifted between a couch state and a bed state. Such items of furniture have been known for over a century and are also known as futons.

[0004] A futon includes a main frame which has opposite end members and connecting cross members therebetween, the end members functioning as armrests when the futon is in a couch state and as headboards and baseboards when in a bed state. Located within the main frame are a back frame and a seat frame, these frames being pivotally connected and supporting a unitary mattress or cushion. Linkage support assemblies connected to the end members support the back and seat frames above the floor on which the futon is placed and control their movements relative to the main frame and to each other.

[0005] A typical futon, known as a China Syndrome futon, is depicted in Fig. 1. It includes a frame 100 having end members in the form of generally n-shaped tubular steel arms at its opposite ends (only the right side end member 101 is shown in Fig. 1) and cross bars 102,103 connected therebetween. Supported between the end members by "Asian" support mechanisms (not shown) are a seat frame 104 and a back frame 105, these frames being pivotally connected along pivot line 106. The seat and back frames support a rectangular cushion or mattress (not shown). The "Asian" support mechanisms control movement of the seat and back frames between a bed positioning (solid lines in Fig. 1) and a couch positioning (dashed lines in Fig. 1).

[0006] As can be seen from Fig. 1, when the seat and back frames are in a bed positioning, the pivot line 106 is located at about a midpoint of the depth of the end member 101 (normally about 31 inches). The seat and back frames each normally have a depth, measured from pivot line 106, of about 27 inches. Thus, when in a bed positioning, the distance D will be about 11.5 inches ($54 - 31 \div 2 = 11.5$). However, the true distance W from the backing wall, measured from the top of the back frame 105, is 11 inches. Both the seat frame 104 and the back frame 105 are connected to the support mechanism at center lines F. The uppermost center line F for the back frame is located relatively close to the lower end of the back frame. Thus, because in the couch positioning the back frame will have no reinforcing support above center lines F, there will be a significant flexing thereof when subjected to the weight of

an occupant leaning backwardly against it. At the same time, the seat frame 104 has no leg for support of the forward end thereof, so that in the bed positioning, the futon can become unstable when an occupant sits on the front end of the seat frame.

[0007] A need exists for an improved wall-hugger futon which can be placed closer to a backing wall than known futons. In addition, a need exists for a futon which has better reinforcing support for its back frame when in a couch state and better front end support for the seat frame when in a bed state.

SUMMARY OF THE INVENTION

[0008] The futon of this invention includes a main frame having left and right end members and front and rear cross elements connected therebetween, back and seat frames which are located between the end members and are pivotally connected, and a support mechanism for movably mounting the back and seat frames relative to the end members and for enabling the back and seat frames to move between a couch positioning and a bed positioning. The support mechanism includes left and right linkage subassemblies and left and right leg subassemblies. Each of the left and right linkage subassemblies includes an arm mounting plate attached to an adjacent end member of the main frame, a seat link pivotally connected to and between the arm mounting plate and the seat frame, and upper and lower back links pivotally connected to and between the arm mounting plate and the back frame. The seat link, together with the upper and lower back links, cause the seat frame and the back frame

to move and reorient relative to the main frame and to one another as the futon is shifted between a couch state and a bed state without creating a large swing of the top end of the back frame towards a backing wall. The upper back link is attached to the back frame at a point about half way along its depth to provide enhanced reinforcing support for the back frame when the futon is in a couch state.

[0009] The left and right leg subassemblies are respectively attached to the front end of the seat frame and include retractable legs for contacting the floor beneath the futon when shifted to its bed state. In one embodiment the leg subassemblies are connected to the respective left and right linkage subassemblies so that the legs will be automatically deployed when the back and seat frames are moved to their bed positioning, and to retract when moved to their couch positioning. In another embodiment the leg subassemblies are manually deployed and retracted, and include springs for biasing the legs in either a deployed or a retracted state.

[0010] Further features and advantages of the invention will now be better understood by reference to the accompanying drawings, taken in conjunction with the following discussion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In the drawings,

[0012] Fig. 1 is a schematic side view of a futon according to the prior art and depicting the relative movements of the seat and back

frames relative to each other and to a backing wall as the linkage support mechanism (not shown) which mounts the seat and back frames and controls their movement between a bed positioning (solid lines) and a couch positioning (dashed lines);

[0013] Fig. 2 is a schematic front view of a futon in accordance with the present invention when the seat and back frames have been shifted by the linkage support mechanism to a bed positioning;

[0014] Fig. 3 is a cross sectional view of the futon as seen along line 3-3 of Fig. 2;

[0015] Fig. 4 is a view of the seat and back frames as seen along line 4-4 of Fig. 3;

[0016] Fig. 5 is a cross section of the frame as seen along line 5-5 of Fig. 4;

[0017] Fig. 6 is a cross sectional view of the futon when the seat and back frames have been shifted by the linkage support mechanism intermediate a bed positioning and a couch positioning;

[0018] Fig. 7 is a cross sectional view of the futon when the seat and back frames have been shifted by the linkage support mechanism to a couch positioning;

[0019] Fig. 8 is a diagram of the futon showing the movement through space of certain pivot points of the support mechanism as the

seat and back frames are moved from a couch positioning to a bed positioning; and

[0020] Fig. 9 is a schematic view of a portion of an alternative leg subassembly of the futon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] A futon according to a preferred embodiment of the present invention is schematically shown in Figs. 2-8. It includes a rigid main frame 10 that is formed by left and right end members 11, 12 and front and rear cross members 13, 14, the front and rear cross members extending between the left and right end members. As can be seen in Fig. 3, the left end member 11 includes a generally n-shaped tubular element 11a that defines two downwardly-extending legs 11b, 11c for contacting the flooring surface on which the futon is located, and a cross element 11e that extends between the legs 11b, 11c. The upper surface 11d of tubular element can function as an armrest. The right end member 12 is identically constructed.

[0022] The futon also includes a seat frame 20 and a back frame 30 which are pivotally connected together and on which a mattress or cushion 40 is placed. As can be seen in Fig. 3, the seat frame 20 includes a front segment 20a, left and right side segments 20b, 20c, and rear segment 20d and spaced cross segments 20e that extend between the front and rear segments 20a, 20d. Downwardly-extending eye brackets 20f, 20g are located beneath the front sides of respective side segments

20b, 20c. A mounting bracket 21 is connected to the rear end of left vertical side segment 20b by bolts 22 (see Fig. 5), and it includes a vertical flange 21a that defines a horizontal hole for a pivot pin 35. A mirror-image mounting bracket 23 is attached to the rear end of right side segment 20c by bolts 24, this mounting bracket including a vertical flange 23a that has a horizontal hole (not labeled) for a pivot pin 36.

[0023] The back frame 30 includes a front segment 30a, left and right side segments 30b, 30c, rear segment 30d (see Fig. 3), and spaced cross segments 30e which extend between the front and rear segments 30a, 30d. A mounting bracket 31 is attached to the front end of left side segment 30b by bolts 32, and it includes a vertical flange 31a that defines a horizontal hole (not labeled) for pivot pin 35. A mirror-image mounting bracket 33 is attached to the front end of right side segment 30c by bolts 34, and it includes a vertical flange 33a that includes a horizontal hole (not labeled) for pivot pin 36. Thus, the seat and back frames are pivotable relative to one another about pivot pins 35, 36.

[0024] The seat and back frames 20, 30 are movably supported relative to the left and right end members 11, 12 by a support mechanism that includes left and right linkage subassemblies 50, 50a, and left and right leg subassemblies 70, 70a. A stabilizer member 51 extends between the leg subassemblies (see Fig. 2). The right linkage subassembly 50a is a mirror image of the left linkage subassembly 50, so a description of the left linkage subassembly suffices for both.

[0025] As best seen in Fig. 3, the left linkage subassembly 50 includes an arm mounting plate 52 that includes holes 53 for attachment to the cross element 11e with suitable connection means such as screws or bolts (not shown.) An angled seat link 55 is pivotally connected at its lower end to the arm mounting plate 52 at pivot point 56, and at its upper end to the mounting bracket 21 at pivot point 57 (see Fig. 5). An angled lower back link 60 is pivotally connected at its lower end to the arm mounting plate 52 at pivot point 61, and at its upper end to the bracket 31 at pivot point 62. An angled upper back link 65 is pivotally attached at its lower end to the arm mounting plate at pivot point 66, and at its upper end to the mounting bracket 31 at pivot point 67. The pivot point 67 is located about half way along the depth of the back frame.

[0026] The arm mounting plate 52 and the links 55, 60 and 65 provide a four element linkage that controls movement of the seat and back frames 20, 30 so that they move and reorient relative to the main frame 10 and pivot relative to each other as they shift between a bed positioning (Fig. 3) and a couch positioning (Fig. 7). Fig. 8 depicts the spacial movement of pivot points 52, 62 and 67 as the futon is shifted from a couch state to a bed state.

[0027] The left and right leg subassemblies 70, 70a are mirror images of one another, so a description of the left leg subassembly 70 suffices for both. As seen in Fig. 3, the left leg subassembly includes a generally L-shaped leg member 71 which is pivotally connected to the bracket 20f at pivot 72, this pivot being at the intersection of long

segment 71a and short segment 71b of the leg member (the corresponding leg member of the right leg subassembly is pivoted connected to bracket 20g). A drive link 73 is pivotally connected at one end to the short segment 71b at pivot 74 and at its opposite end to a bracket 80 at pivot 75. Bracket 80 is attached to the seat link 55. When the left support subassembly 50 controls the shifting of the seat frame and back frame from a bed positioning to a couch positioning, the drive link 73 will cause the leg member 71 to pivot about pivot 72 and be retracted from its extended, floor-engaging positioning (Fig. 3) to a retracted positioning beneath seat frame 20 (Fig. 7). A reverse action occurs when the seat and back frames are shifted from a couch positioning to a bed positioning. The leg member 71 is moved sufficiently high by the front of the seat frame 20 to avoid contact with the front cross member 13.

[0028] Fig. 9 shows an alternative embodiment of leg subassembly wherein the drive link 73 is eliminated (also the drive link of the right leg subassembly) and the leg member 71 is replaced by a leg member 81 which is pivotally attached at its upper end to the left side segment 20b of the frame 20 at pivot knob 82, and a spring 83 is connected at one end to a mounting pin 84 on the leg member and at its other end to a knob 85 on the left side segment 20b. The leg member 81 (and corresponding leg member of the right linkage assembly) is pivoted about pin pivot knob 82 by manually moving the stabilizer member 51 between a down position (solid lines in Fig. 9) and a retracted position

(dashed lines in Fig. 9), with the spring 83 assisting in maintaining the leg member in the desired positioning.

[0029] Although preferred embodiments of the invention have now been shown and described in detail, modifications therein can be made and still fall within the scope of the appended claims.